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NICKEL SMELTING IN THE USSR

The first nickel plant, the Ufaley, was built in the Soviet Union in 1933. In 1936 another plant, the Rezhsk, was built, and somewhat later the Orsk plant (INRA) came into existence. These plants work on oxidized ores.

For the processing of sulfide copper-nickel ores, the following plants were constructed: Sovoronikel, Noril'sk, and Pechenga Nikel.

The Ufaley nickel plant is supplied with oxidized nickel ore which is mined in Ufaley Bayom. The nickel deposits on this area are still in the process of prospecting.

Because French specialists were in charge of construction of the Ufaley smelter, production methods at this plant are antiquated, being the same as the methods used at the New Caledonia plants. The work of the plant has proved defective in a number of respects. Several changes in the smelting process have been made, but essentially the character of the smelting methods remain the same.

In November 1936, the Rezhsk nickel plant entered production, utilizing small local deposits of oxidized nickel ores of Rezhsk Rayon. This plant uses a simplified method of smelting raw ore in a water jacket, without preparation with gypsum, limestone, and reverse slags. The raw metal thus obtained is poured into molds, and the ingots are sent to the Ufaley plant.

The Orsk plant operates on oxidized nickel ores which are mined in Orsk-Khalilovo and Aktymbinsk rayons. Ore processing passes through the following stages: agglomeration by means of Dwight Lloyd machines, smelting the agglomerate in water jackets in a mixture of gypsum or pyritic tails, blowing the raw metal in converters, roasting the intermediate metal sulfide (feinstein) in mechanical ovens, smelting the oxide in electrical ovens, and pouring nickel into granules.

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The copper-nickel ores of the Kola Peninsula are processed at the Severonikel and Pechenga Nickel plants. Part of the ore is dressed while the rest goes into the oven in a raw state, owing to the scarcity of fuel in the region. The raw metal obtained is blown in a converter until it becomes feinstein. The feinstein is then processed by the Orford method. Rich nickel ores made up of large lumps are smelted in water jackets without preliminary dressing.

The Noril'sk copper-nickel ores are processed locally on account of the availability of coal at Noril'sk. The high-quality ore consisting of large lumps is smelted in water jackets by means of semipyrritic smelting. On the other hand, the fine and low-grade impregnated ore goes through preliminary dressing. The concentrate, together with the dust and fines, is agglomerated in Dwight Lloyd machines, and is smelted in water jackets. The raw metal is blown in a converter to obtain feinstein which is processed locally by the Orford process. In the future, it is proposed to introduce the process of selective flotation, and eliminate the Orford process.

Nickel ingots and granules are of two kinds: the metal may be obtained by recovering pure oxides of nickel in a mixture of charcoal, or by electrolytic smelting. In the latter case, the metal is of considerably higher quality. The entire production of the Ufaley and Orsk plants is of the first type. Metal is obtained by smelting oxides of nickel with coal.

Table 1. Standards of USSR Nickel

Grade	Ni + CO Not Less Than %	Including Co Not Less Than %	Impurities Not More Than %				
			Fe	Si	C	S	Cu
H1	99.5	0.6	0.25	Traces	0.10	0.02	0.10
H2	98.5	1.0	0.60	0.15	0.15	0.03	0.25
H3	98.5	1.0	--	--	0.30	0.03	0.60
H4	97.5	1.0	--	--	0.30	0.05	0.60

The USSR nickel does not contain the Mond fraction. The Mond fraction differs from electrolytic nickel mainly by a lower content of cobalt. This type of nickel is required only for thermoelectric alloys, and the USSR standards do not provide for it.

A comparison of USSR nickel standards with those of foreign countries discloses a higher copper content in Soviet nickel due mainly to the fact that the nickel ores of the USSR are contaminated with copper to a larger extent than foreign ores.

Nickel Ores

There are three types of ores used in the smelting of nickel: oxidized (silicate) ores, sulfide copper-nickel ores, and arsenic.

The Ufaley and Rezhs deposits belong to the first type, and the Orsk and Aktyubinsk deposits to the second type. The third type is an iron-nickel ore. When the iron content of this ore is sufficiently high, it is sent to the smelter for the production of alloyed pig. Iron-nickel ores are mined in the following deposits: Elizavetinsk, near Sverdlovsk; Khalilovo, near Orsk; and Malkinsk, in the Northern Caucasus.

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